



Transportation Synthesis Report

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Constructability Reviews, V. 2

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Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WisDOT technical staff in highway development, construction and operations. Online and print sources include NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete.

REQUEST FOR REPORT

The constructability (sometimes spelled “-ibility”) review process (CRP), in which contractors, industry experts, project engineers, or the public comment on project plans before groundbreaking, is designed to save time and money. The RD&T Program was asked to find out the extent to which constructability reviews are used by other state DOTs and how the process is carried out. RD&T searched national and state information sources to find the preliminary information in this report.

SUMMARY

Constructability reviews seem to enjoy widespread practice in transportation agencies around this country, though how commonly employed as a formal process remains a matter of dispute. University of Kentucky researchers reported in 2004 that 58 percent of state DOTs – 29 states, presumably – employ formal constructability review processes; while Texas A&M researchers claimed only 25 percent of states have such programs.

We detail 12 states, below, that run formal programs for constructability reviews, and we note six other states with constructability practices cited in a 2000 AASHTO report. In every case the results have pleased the participants. In California, for instance, constructability reviews address environmental concerns, traffic problems, and noise pollution issues before any of these materialize; as the practice spreads, more participants stress such benefits, in addition to the expected cost and time reductions. A few agencies keep the process an internal one, but most look outside their walls, employing contractor associations for rosters of reviewers, soliciting comments from all contractors eligible to bid, or seeking public input. California continues to conduct a pilot of “enhanced” constructability review with contractors making comments on a Caltrans Web site, though the temporary status has not impeded formalizing review processes.

STATE PRACTICES

Only three of the following twelve transportation agencies keep the constructability review process entirely internal, and of those, Maryland does so by employing someone retired from the construction industry. After experimenting with externalizing the process via the Internet, California has been enjoining consultants and construction industry personnel in an externally involved process. Most states practice this in some form, drawing comments from outsiders in contractor associations, on pre-qualification lists, or from public hearings or Web site comments. Traditionally engaged on large projects only, constructability reviews are moving into all transportation construction or rehabilitation projects.

Externally Involved Process

Arizona. See pp. 126-127, <http://ops.fhwa.dot.gov/wz/practices/best/Documents/workzoneguidebook.pdf>. In Arizona, CRP attempts to involve the public.

- On all major new or reconstruction projects, it invites comment on designs, using community input to reshape plans in what seems a public relations effort designed to give a community a sense of ownership on individual construction projects.
- For large, generally urban freeway projects, a second process, called Traffic Management Workgroups, gathers representatives from various civic groups and municipal agencies, as well as engineers, to review upcoming projects with a view toward community-sensitive design and scheduling.

According to a 2004 report of problem statements from TRB's Construction Management Committee – <http://gulliver.trb.org/committees/rps2004/AFH10.pdf> – an Arizona DOT study of constructibility reviews found the process produced a 25 to 1 cost-benefit ratio, that is, a return of \$25 in savings for every \$1 spent in review.

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California. http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=23&from=topindex&Category_id=90. Implemented for all projects over \$750,000, looking at traffic, design, construction, maintenance and more. Features and practices of the process in California have been noted in various publications and web sites.

- Focuses on reducing project construction time, maintenance needs, public inconvenience.
- On the ongoing Sacramento River Bridge project, Caltrans honed design choices to address environmental concerns over migratory fish, highway and river traffic, and noise pollution. See "Caltrans Rebuilds Sacramento River Bridge." K. Stidger, *Better Roads*, v. 72 (8), August 2002, pp. 36-41; <http://www.betterroads.com/articles/aug02c.htm>.
- A new process, called Enhanced Constructability Review, allows highway construction industry members to review and comment online upon the constructability of preliminary designs. The site links review documents from certain projects. See <http://www.dot.ca.gov/hq/esc/oe/ecr/>. For a list of projects which involved constructability reviews in one district, see http://www.dot.ca.gov/dist11/construc/ecr/ECR_comments.html.
- Holds constructability review meetings to be held before approval of project study reports; see <http://www.smcta.com/streets/TA621.asp>.
- Involves contractors via groups like Associated General Contractors; see <http://california.construction.com/news/transportation/archive/0310.asp>.
- According to AASHTO's best practices guide (see **National Information Sources**, below), California conducts reviews internally, and uses a three-tiered process, entailing reviews at initiation of design, and again, depending on project type, at 30, 60, and 95 percent design stages (see pp. 5, 9-11, 15 of <http://www.transportation.org/community/reports.nsf/By+Category+Public?openview>).
- *Constructability – A case study in transportation project delivery: San Francisco-Oakland Bay Bridge New East Span*, Norman Mineta International Institute for Surface Transportation Policy Studies, June 2002. <http://transweb.sjsu.edu/educ/capstones/2002picker.pdf>. Project managers bear the responsibility of conducting constructability reviews, and the process works best when conducted concurrently with value engineering during the design phase.

Jim Deluca, Senior Transportation Engineer, 916-653-4067 or jdeluca@trmx3.dot.ca.gov.

Colorado. http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=73&from=topindex&Category_id=90. On complex or high visibility projects, when project plans are 30 percent complete, a contractor from the Colorado Contractor's Association reviews and critiques plans. Done for cost savings and reduced congestion during construction.

Frank Muldowney, Safety Services, Maintenance and Operations Branch, 303-273-1840.
Ed Fink, Maintenance Superintendent., Maintenance and Operations Branch, 303-273-1840.
Peter Eun, Safety Program Engineer, FHWA, Colorado Division, 303-969-6730, ext. 376 or Peter.Eun@fhwa.dot.gov.

Indiana. http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=137&from=topindex&Category_id=90. Team approaches to various disciplines have proved rewarding to the DOT on high visibility (urban freeway) projects. Part of the DOT's Transportation Management Plans and includes all planning stages from scheduling and timing with other projects to traffic control and design. James Poturalski, Chief of Contracts and Constructions, 317-232-5502 or poturalski@indot.state.in.us.

Kentucky. The Kentucky Transportation Cabinet is developing a formal constructibility review process. Much of what it develops appears likely to be based on the following studies KyTC commissioned from the University of Kentucky.

Constructibility Issues on KyTC Projects, University of Kentucky, July 2003. See

http://www.ktc.uky.edu/Reports/KTC_03_17_SPR_236_02_1F.pdf or 2004 TRB Practical Papers CD-ROM.

This report makes a case for KyTC to implement a formal constructibility review process. Points of interest include:

- Constructibility reviews should be driven by a KyTC “sponsor” in the central office and in district offices, a person who will set objectives, select contract strategies, select outside consultant participants, and fund the process during planning and design.
- Issues to be faced in so doing include traffic control, existing utilities, geotechnical, ROW, bridge structures, and new utilities.
- Nationally, 58 percent of state DOT’s have formal constructability review processes; the four most common barriers to constructability review programs are time, available manpower, experience, and contractor reluctance to participate.
- See also a Research Brief at <http://www.ktc.uky.edu/researchbrief2002.pdf>.

A Statewide Lessons Learned System for the Kentucky Transportation Cabinet, University of Kentucky, Aug. 2003.

See http://www.ktc.uky.edu/Reports/KTC_03_25_SPR_262_03_1F.pdf or 2004 TRB Practical Papers CD-ROM.

This research develops a Lessons Learned System by which KyTC can take problems and solutions from previous projects and integrate them into a system to be accessed during design, constructibility review, and construction. See slide presentation at <http://www.kytc.state.ky.us/design/partner/Constructibility%20Review%20-%20Partnering%20Meeting.ppt>.

North Carolina.

http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=183&from=topindex&Category_id=90. Used in major rehabilitation and new construction of high-volume, urban freeways with environmental mitigation concerns, and draws on members of North Carolina Contractor’s Association for review. Constructability reviews have decreased contract times, occasionally quite dramatically, and have reduced contract costs, user costs and improvements in traffic control designs.

Steve DeWitt, P.E., State Construction Engineer, NCDOT, 919-733-2210.

Bradley Hibbs, Traffic Operations and Safety Engineer, FHWA, North Carolina Division, 919-856-4354, ext. 145.

Oklahoma.

http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=218&from=topindex&Category_id=90. By submitting projects of over \$5 million for review to all eligible contractors before advertising project, Oklahoma has produced economical and efficient projects, with errors eliminated before bidding. Process also results in more accurate bids from contractors that have become very familiar with the projects. Oklahoma requires of contractors bidding on a project attendance at constructability review meetings – see p. 2 of a 2004 Notice to Let at <http://www.okladot.state.ok.us/contracts/a2004/pdfs/short0402.pdf>.

Jack Stewart, Specifications Engineer, 405-521-2625.

Oregon. http://www.oregon.gov/ODOT/CS/CCS/constructability_reviews.shtml. ODOT draws from a list of registered contractors for its CRP, as well as for a post-construction review. The process is designed to cut construction costs, reduce work schedule length, reduce change and extra work orders, and improve public and construction safety. The program won an award from the National Partnership for Highway Quality award in Dec. 2002 – <http://www.tfhr.gov/focus/dec02/03.htm>. Important elements of ODOT’s program include:

- Project leaders manage the CRP on location, but responsibility ultimately falls on the Project Delivery Business Line leader. The review entails two stages.
- The first stage, an Internal Review, entails having the Project Team for the particular project review project plans internally in a meeting conducted by the Project Leader. Focus should be on staging and environmental matters. An informal review, this should be conducted for all projects, regardless of complexity.
- For the second stage, an External Review, the project leader enlists at least two registered reviewers from Associated General Contractors of Oregon. Following receipt of plans and appropriate material, a review meeting is conducted when plans are 30 to 50 percent complete.

Mike Wolfe, Project Delivery Business Line Leader, 503-986-4412.

Virginia. http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=48&from=topindex&Category_id=90. On major projects, independent consultants and sometimes contractors review project plans to help sequence work, optimize construction time and lessen impact on traffic.

Frank Gee, State Construction Engineer, VDOT, 804-786-2785 or gee_cf@vdot.state.va.us.

J.T. Mills, State Location and Design Engineer, VDOT, 804-786-2507 or Mills_jt@vdot.state.va.us.

Internal Process

Florida. http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=91&from=topindex&Category_id=90. FDOT personnel participate in constructability review early in design stages on all projects, an effort to create a smooth construction product by increasing quality, reducing inconvenience to public, curtailing supplemental contracts and claims.

- For policy, see Construction Project Administration Manual (re-codified July, 2002), §1.1, Plans Review and Comments in Ch. 1 of Pre-Construction, <http://www.dot.state.fl.us/construction/manuals/cpam/CPAM70000000/New%20Clean%20Chapters/ch1s1%20Plans%20&%20Comments.pdf>.
- One internal survey at FDOT in 2004 suggested utilities arrangements can be a problematic issue in constructability reviews; see p. 8 of <http://www.dot.state.fl.us/rddesign/SurveyResults/Internal%20Survey%20Report%2004-01-04%20to%2006-30-04.pdf>.
- According to AASHTO's best practices guide (see **National Information Sources**, below), Florida conducts constructability and bid-ability reviews at 30 and 60 percent design phases when FDOT construction staff is involved (see p. 10 of <http://www.transportation.org/community/reports.nsf/By+Category+Public?openview>).

John Shriner, State Scheduling Engineer, Florida DOT, 850-414-4149 or john.shriner@dot.state.fl.us.

Patrick Bauer, Program Operations Engineer, FHWA, Florida Division, 850-942-9650, ext. 3035 or patrick.bauer@fhwa.dot.gov.

Maryland.

http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=151&from=topindex&Category_id=90 and <http://www.sha.state.md.us/aboutus/orgchart/obd/obd.asp>. The State Highway Administration's Bridge Quality Assurance Unit conducts constructability reviews. The state keeps a retired bridge engineer on staff part-time, a person who lends over 35 years of bridge-building experience to the design process. The state considers constructability review an important part of context-sensitive design initiatives (<http://www.fhwa.dot.gov/csd/mdnew.htm>).

Bob Harrison, Deputy Chief Engineer of Construction, 410-545-0072 or rharrison@sha.state.md.us.

Texas. See p. 145 of <http://ops.fhwa.dot.gov/wz/practices/best/Documents/workzoneguidebook.pdf>. On major projects, Texas addresses constructability in its Value Engineering process, with a focus on traffic management.

- The Texas Transportation Institute notes that the process engages during planning and design and operates through construction; see http://tti.tamu.edu/inside/cdv/general/research_results.stm.
- Project Development Process Manual. http://manuals.dot.state.tx.us/dynaweb/coldesig/pdp/@Generic_BookTextView/12692;cs=default;ts=default. TxDOT assigns the review process to the roadway design engineer, and requires it on all projects save preventive maintenance and restoration contracts.

Robert R. Kovar, Deputy Director of the Design Division, 512-416-2242 or RKOVAR@dot.state.tx.us.

Mark Marek, Engineer of Geometric Design, Design Division, TxDOT, 512-416-2653.

NATIONAL INFORMATION SOURCES

Constructability garners research attention in NCHRP studies, AASHTO committee efforts, and FHWA offices.

Construction Engineering and Management Research Program, Russell, Jeffrey, Stuart Anderson, David Trejo, and Awad Hanna, NCHRP Web Document 51, Nov. 2002.

http://trb.org/publications/nchrp/nchrp_w51.pdf. A joint study by UW-Madison and Texas A&M, this large document includes surveys of states in the data it gathers to present the state of the practice and implementation recommendations for constructability review processes and other construction issues. See, for example,

§3.7.14 on pp. 122-125 for a review of practices, and §4.5.13 on pp. 162-163 for an implementation plan.

Cost/Benefits of Constructibility Reviews, NCHRP, April 12, 2002.

<http://transportation.org/download/ConstructabilityReviews.pdf>. An excellent overview of the process and its cost benefits. Commissioned by the NCHRP, it includes recommendations for newcomers to the process. (Large 11 MB file requires a minute or so to download.)

Constructability Review Best Practices Guide, AASHTO Subcommittee on Construction, Aug. 2000. Link at <http://www.transportation.org/community/reports.nsf/By+Category+Public?openview>. Reviews practices of various states. Heading the task force behind this guide is Art Gruhn of Connecticut DOT: arthur.gruhn@po.state.ct.us, or 860-594-2680. Of interest include comments on states not highlighted above:

- **New Jersey** conducts reviews internally (p. 5);
- **Washington** conducts reviews internally with the help of a team of engineers, inspectors, construction managers, and others; Washington also assigns duties to consultants in “design agreements” (pp. 5, 7, 11, 13, 15);
- **Connecticut** uses internal review by construction staff for most projects, external for selected large and complex projects, and conducts reviews at 30-50 percent plan completion (5-6, 10-11, 15);
- **Pennsylvania** hired a retired contractor to conduct reviews and also uses external experts (6-7);
- **Kansas** assigns review to a task force of DOT and contractor organization members (6);
- **Maine** involves construction representatives on certain project reviews (6);
- A list of states with constructability review programs and contacts, based on a 1999 survey (23-24).

Best Practices Guide Update (in progress), AASHTO Subcommittee on Construction, Environment and Human Resources Section. See statement of intention to update at

<http://construction.transportation.org/?siteid=58&pageid=737>; the work was completed, according to a review at <http://cms.transportation.org/sites/construction/docs/2003-2004%20Work%20Plan%20Accomplishments.pdf>. This subcommittee completed in its 2003-2004 work plan work on updating the Constructability Review Best Practices Guide to include post-construction review practices.

Constructability Review Process for Transportation Facilities, NCHRP Project 10-42, Texas A&M Research Foundation, Stuart D. Anderson and Deborah J. Fisher, completed Dec. 31, 1996. Available in the WisDOT Library, 8th Floor HFSTB.

1. NCHRP Report 390, Constructability Review Process for Transportation Facilities, published in 1997.
2. NCHRP Report 391, Constructability Review Process for Transportation Facilities – Workbook, published in 1997.

FHWA Office of Operations. The following sites contain information summarized above in state practice descriptions: <http://ops.fhwa.dot.gov/wz/practices/best/topindex.asp?id=90> and ops.fhwa.dot.gov/wz/practices/best/Documents/workzoneguidebook.pdf.

JOURNALS

In the last several years, as constructability reviews become more widely practiced, journal articles on the process have shifted focus from benefits in project costs and brevity to environmental and other benefits, like reductions in noise pollution, increased traffic efficiency, and improved future maintainability.

“Managing Constructibility Reviews to Reduce Highway Project Durations,” Ford, David, Stuart Anderson, Andrew Damron, Rodrigo de Las Casas, Nevzat Gokmen, and Steven Kuennen. *Journal of Construction Engineering and Management*, v. 130(1), Jan. 2004, pp. 33-42.

<http://ceprofs.tamu.edu/dford/DNF%20Profesional/ConstructabilityReviewsASCE.pdf>. Authors consider various models of constructability reviewing, and find that large and small review projects produce less project duration savings than do moderately sized processes. The article claims only one quarter of state highway agencies have formal constructability review programs in place.

“Constructability Analysis in the Design Firm,” Arditi, David, Ahmed Elhassan and Y. Cengiz Toklu.

Journal of Construction Engineering and Management, v. 128(2), March 2002, pp. 117-126. For abstract, or full text with ASCE membership, see <http://scitation.aip.org/dbt/dbt.jsp?KEY=JCEMD4&Volume=128&Issue=2>. (Order through WisDOT Library, 8th Floor HFSTB.) As a design interest, constructability has been engaged earlier and earlier in project planning stages. This piece looks at designer practices and recommends steps for performing reviews.

“Expanded Constructability Reviews,” G. Berthelsen. California Department of Transportation Journal, v. 2 (4), Jan. 2002, pp. 42-45.

http://www.dot.ca.gov/dist07/aboutdist7/pubs/journals/Jan_Feb_2002/html/Journal_Jan_Feb_2002.html. California DOT uses the process to reduce change-order delays and costs after construction has started. Caltrans seeks input from a wide array of relevant engineers on traffic handling, weather conditions, local geographic features; teams a resident engineer with design engineer to analyze plans; solicits comments from contractors before bidding.

“Integrating Constructability into Project Development: A Process Approach,” Anderson, Stuart, Deborah Fisher, and Suhel Rahman. *Journal of Construction Engineering and Management*, v. 126 (2), March 2000, pp. 81-88. For abstract, or full text with ASCE membership, see

<http://scitation.aip.org/dbt/dbt.jsp?KEY=JCEMD4&Volume=126&Issue=2>. (Order through WisDOT Library, 8th Floor HFSTB.) Authors describe development of an NCHRP project to create a constructability review process in three stages: planning, design and construction. Developed seven functions for each phase, and tested in two transportation projects.